(12) UK Patent (19) GB (11) 2 197 783 (13) B

(54) Title of Invention

Liquid applicator

(51) INT CL⁴ ; A46B 11/02

(21) Application No
8726646.6

(22) Date of filing
13 Nov 1987

(30) Priority data

(31) 61174287U

(32) 13 Nov 1986

(33) JP

(43) Application published
2 Jun 1988

(45) Patent published
9 May 1990

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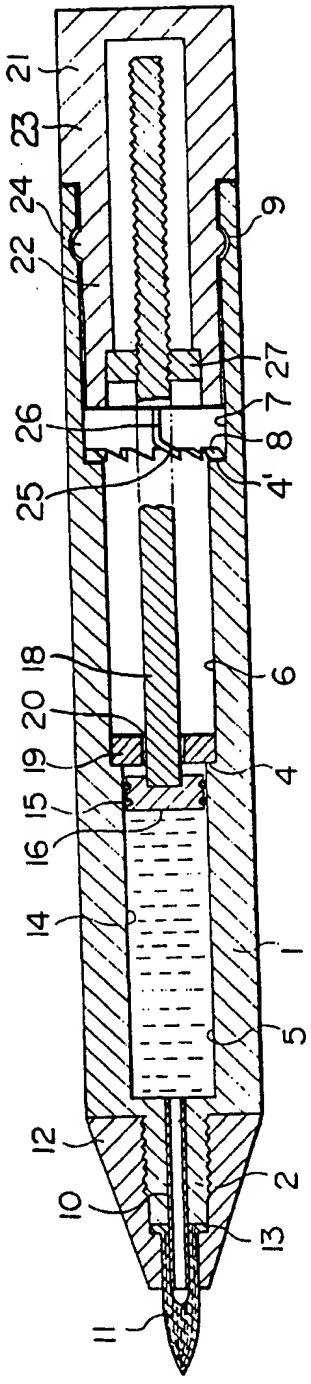
(52) Domestic classification
(Edition J)
A4K KBA K157 K158 K167
K175
U1S S1120 S1124 S2258

(56) Documents cited
None

(58) Field of search

As for published application
2197783 A *viz:*
UK CL A4K
INT CL⁴ A46B
updated as appropriate

2197733



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LIQUID APPLICATOR

The present invention relates to a liquid applicator such as: cosmetic instruments employing cosmetic liquid such as an eyeliner, mascara, nail polish and the like; writing instruments employing ink such as a marking pen, felt-tipped pen and the like; and other applicator for applying other application liquid, and more particularly to a liquid applicator which forcibly feeds the application liquid to a liquid-application portion of the instrument.

Hitherto, there has been provided a liquid applicator in which: a reservoir portion for receiving the application liquid therein is provided in the interior of a shaft sleeve of the applicator, the reservoir portion communicating with the liquid-application portion of the applicator; an axially-movable member such as a piston is mounted in the reservoir portion of the applicator; a rotary control member is provided in a rear-end portion of the shaft sleeve of the applicator, and rotatably driven to move the axially-movable member such as the piston forward in a screw-driving manner so that the

application liquid is forcibly fed to the liquid-application portion from the reservoir portion of the applicator. Such conventional liquid applicator is disclosed in, for example, Japanese Utility Model Publication No. 50-10925.

In such conventional liquid applicator, however, in case that it is necessary to keep a feed rate of the application liquid at a certain level, namely, in case that the axially-movable member such as the piston of the applicator is advanced at a certain rate, it is necessary to precisely control the rotary control member of the applicator in its rotation. However, it is very cumbersome for the user to precisely control the rotary control member of the applicator even when a graduated scale is provided in a rotary knob of the rotary control member of the applicator, because the reading of such scale makes the user tired and leads to misreading. Such misreading often causes the rotary control member to be reversely rotated so that air is sucked into the reservoir portion of the applicator and expanded when the temperature of the applicator increases. Such expansion of the air in the reservoir portion causes the application liquid to drop from the liquid-application member of the applicator. These are problems inherent in the conventional liquid applicator. Therefore,

the present invention provides a novel liquid applicator which may resolve the above problems.

According to the present invention, there is provided a liquid applicator comprising: a tubular shaft sleeve; a liquid application member at a front-end portion of said shaft sleeve; a liquid reservoir portion communicating with said liquid-application member, said reservoir portion being provided in said shaft sleeve; a piston in said reservoir portion so as to be axially slidable while in sealing contact with said reservoir portion; a threaded rod connected to said piston, said threaded rod being provided with a male screw portion at least at its rear portion; means for preventing said threaded rod from rotating; a rotary control sleeve rotatably mounted at a rear-end portion of said shaft sleeve, said rotary control sleeve being prevented from moving in an axial direction of said shaft sleeve, and having at least one resiliently-deformable engaging projection at its front end; a driving means for driving said threaded rod, said driving means being provided in said rotary control sleeve; and a concavo-convex portion on an inner wall of said shaft sleeve, said concavo-convex portion engaging with said resiliently-deformable engaging projection so that relative movement between the concavo-convex portion and the projection can take place in a single direction only.

It is preferable that said concavo-convex portion of said shaft sleeve consists of perpendicular walls extending substantially parallel to a longitudinal axis of said shaft sleeve and oblique walls extending from said perpendicular walls at an acute angle, said perpendicular walls being spaced alternately with said oblique walls.

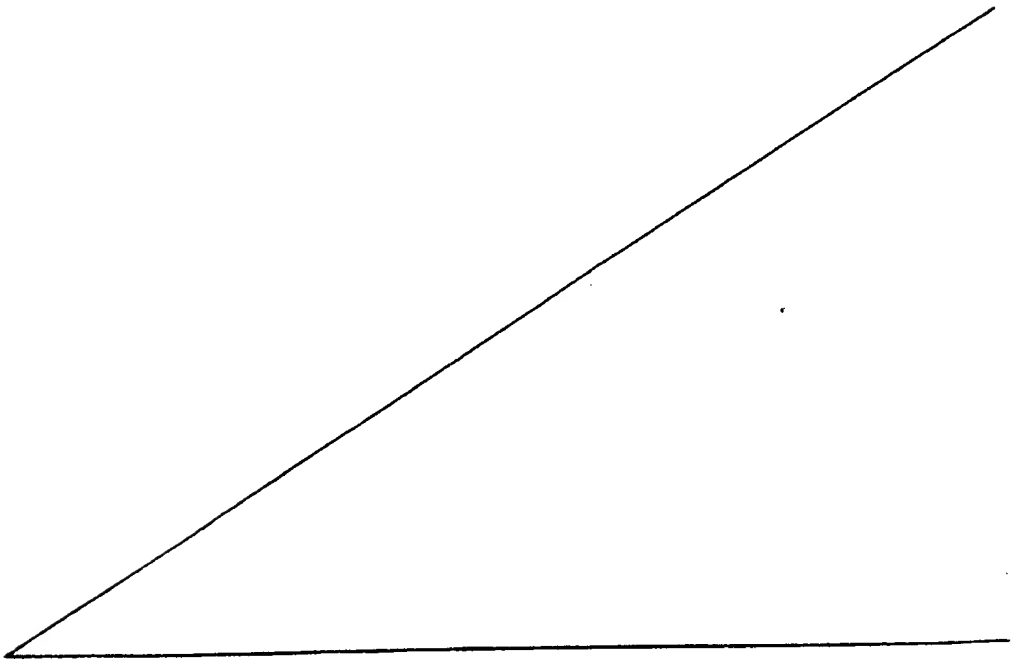
The driving means for driving the threaded rod may comprise a threaded hole in said rotary control sleeve, said threaded hole being a through-hole. Alternatively, the driving means may comprise a separate member having a female screw which is threadably engaged with said male screw of said threaded rod, said separate member being fixedly mounted inside said rotary control sleeve.

A plurality of the resiliently-deformable engaging projections may be provided at said front end of said rotary control sleeve.

The liquid applicator may be a writing or painting instrument or a cosmetics applicator.

The invention will now be described by way of non-limiting example with reference to the accompanying drawing.

The drawing shows a longitudinal sectional view of an embodiment of the liquid applicator of the present invention.



As shown in the drawing, the reference numeral 1 denotes a tubular shaft sleeve of the liquid applicator of the present invention. In a front-end portion of the shaft sleeve 1 of the applicator, there is provided a small-diameter projection 2 to a front-end portion of which is connected a brush tip 11 which is provided with a rear-end flange 13 in its base portion. A front shaft 12 is threadably connected to the small-diameter projection 2 of the shaft sleeve 1 through the rear-end flange 13 of the brush tip 11 so as to fix the brush tip 11 to the shaft sleeve 1.

The reference numeral 10 denotes a liquid conduit through which a liquid reservoir portion 14 of the shaft sleeve for receiving an application liquid therein communicates with the brush tip 11. The liquid conduit 10 is fixedly mounted in a bore portion of the small-diameter projection 2 of the shaft sleeve 1 so that a front-end portion of the liquid conduit 10 projects outward from the front end of the small-diameter

projection 2 of the shaft sleeve 1 to enter the interior of the brush tip 11 at its front-end portion.

The brush tip 11 communicates with the liquid reservoir portion 14 of the shaft sleeve 1 through such liquid conduit 10, so that the application liquid is fed to the brush tip 11 from the liquid reservoir portion 14 of the shaft sleeve 1 through the liquid conduit 10.

The interior of the tubular shaft sleeve 1 increases stepwise in its inner diameter to form: a first interior part forming the bore of the small-diameter projection 2; a second interior part 5 which is positioned behind the first interior part and larger in diameter than the first interior part or the bore of the small-diameter projection 2, and forms the liquid reservoir portion 14 of the shaft sleeve 1; a third interior part 6 which is positioned behind the second interior part 5 and larger in diameter than the second interior part; and a fourth interior part 7 which is positioned behind the third interior part 6 and larger than the third interior part 6. Shoulder portions 4 and 4' are formed in a position between the second 5 and the third 6 interior parts and in a position between the third 6 and the fourth 7 interior parts, respectively.

A saw-toothed concavo-convex portion 8 is provided in the shoulder portion 4 of the shaft sleeve 1, and

consists of: vertical walls extending substantially parallel to a longitudinal axis of the shaft sleeve 1; and oblique walls obliquing from the vertical walls at an acute angle, the vertical walls being spaced alternately with the oblique walls.

A groove 9 is provided in an inner wall of the shaft sleeve 1 at a position near the rear end of shaft sleeve 1 to extend in a circumferential direction of the inner wall of the shaft sleeve 1.

A piston 16 is axially slidably inserted into the liquid reservoir portion 14 of the shaft sleeve 1. The application liquid is received in the liquid reservoir portion 14 at a position in front of the piston 16. O-rings 15 are mounted on an outer peripheral surface of the piston 16 so that the piston 16 is brought into a sealing contact with an inner surface of the liquid reservoir portion 14 through the O-rings 15 to prevent the application liquid from leaking from the liquid reservoir portion 14. It is possible to replace the O-rings 15 with any other suitable means for preventing the application liquid from leaking from the liquid reservoir portion 14.

A threaded rod 18 is fixed to a rear side of the piston 16, and passes through the third interior part 6 of the shaft sleeve 1 to enter the fourth interior

part 7 of the shaft sleeve 1. A rear-half portion of the threaded rod 18 forms a male screw, while a front-half portion of the threaded rod 18 is not threaded to form a square-column portion.

It is possible that the threaded rod 18 assumes a square-column shape as a whole. In this case, longitudinal edges of such square-column-shaped rod 18 is threaded.

It is also possible that the threaded rod 18 assumes a circular-column shape as a whole.

The reference numeral 19 denotes a stopper means for preventing the threaded rod 18 from rotating about its longitudinal axis, provided that the stopper means 19 permits the threaded rod 18 to move axially relative to the shaft sleeve 1.

The stopper means 19 is provided with a central hole 20 a shape of which corresponds to that of the cross section of the front-half portion of the threaded rod 18, so that the threaded rod 18 is slidably inserted into the central hole 20 of the stopper means 19. Consequently, it is possible for the threaded rod 18 to axially move relative to the stopper means 19, but not possible to rotate about its longitudinal axis. In case that the threaded rod 18 assumes a circular-column shape as a whole, another stopper means is required. For example, a ridge extending in a longitudinal direction of the

shaft sleeve 1 is integrally formed in an outer peripheral surface of such threaded rod 18 to provide such another stopper means, provided that the central hole 20 assumes a shape corresponding to a cross section of such threaded rod 18 having the ridge.

The reference numeral 21 denotes a rotary control sleeve a front-half portion 22 of which is rotatably mounted in the fourth interior part 7 of the shaft sleeve 1. An outer diameter of the front-half portion 22 of the rotary control sleeve 21 is slightly smaller than the inner diameter of the fourth interior part 7 of the shaft sleeve 1 to make it possible that the front-half portion 22 of the rotary control sleeve 21 fits in the fourth interior part 7 of the shaft sleeve 1. An outer diameter of a rear-half portion 23 of the rotary control sleeve 21 is substantially corresponding to the outer diameter of the rear-end portion of the shaft sleeve 1.

An annular ridge 24 corresponding to the groove 9 of the shaft sleeve 1 is provided in the outer peripheral surface of the front-half portion 22 of the rotary control sleeve 21 at a position corresponding to that of groove 9 when the rotary control sleeve 21 is mounted in the fourth interior part 7 of the shaft sleeve 1. Such ridge 24 of the rotary control sleeve 21 engages

with the groove 9 of the shaft sleeve 1 so that the rotary control sleeve 21 is rotatably mounted in the rear-end portion of the shaft sleeve 1, while prevented from moving axially.

A resiliently-deformable engaging piece 26 provided with a hook 25 at its front-end portion is provided in a front-end surface of the rotary control sleeve 21 in a projecting manner. Although the number of such engaging piece 26 is one in the embodiment of the present invention as shown in the drawing, it is also possible to provide a plurality of the engaging pieces 26 in the front-end surface of the rotary control sleeve 21. The length of the of the engaging piece 26 is so adjusted that the hook 25 of the engaging piece 26 reaches the concavo-convex portion 8 of the shoulder portion 4' of the shaft sleeve 1 to engage therewith in case that the rotary control sleeve 21 is mounted in the rear-end portion of the shaft sleeve 1. In this case, the hook 25 of the engaging piece 26 is curved to fit the oblique wall of the concavo-convex portion 8 of the shoulder portion 4' of the shaft sleeve 1. Since the hook 25 of the engaging piece 26 is resiliently deformed to pass the oblique wall of the concavo-convex portion 8 of the shaft sleeve 1, the rotary control sleeve 21 can rotate counterclockwise in a rear-end view of the embodiment

of the liquid applicator of the present invention shown in the drawing. In other words, the rotary control sleeve 21 is prevented from rotating clockwise because the hook 25 of the engaging piece 26 abuts on the vertical wall of the concavo-convex portion 8 to act as a detent.

Inside the rotary control sleeve 21 is provided a driving member 27 which is fixedly mounted in the rotary control sleeve 21 while provided with a female screw in its central portion, which female screw is threadably engaged with the threaded portion of the threaded rod 18. The driving member 27 may be fixed to the rotary control sleeve 21 by means of a suitable means. It is also possible to replace such separate driving means 27 with a threaded hole formed in the rotary control sleeve 21.

The threaded portion or a male screw portion of the threaded rod 18 is threadably engaged with the female screw of the driving member 27 and moves the threaded rod 18 forward when the rotary control sleeve 21 is rotated by the user in the single direction mentioned above.

The threaded rod 18 has a sufficient length so that it is possible to move the piston 16 to the foremost position of the liquid reservoir portion 14 of the shaft sleeve 1.

The above components of the liquid applicator of the present invention may be made of conventional materials. It is also possible to cover the brush tip 11 with a cap (not shown) in order to protect the brush tip 11 from damage.

In operation, the rotary control sleeve 21 is rotated by the user so that the piston 16 is moved forward by the threaded rod 18. Under such circumstances, since the rotary control sleeve 21 is kept stationary in the axial direction of the shaft sleeve 1, the hook 25 of the engaging piece 26 produces a click at each time when the hook 25 passes the oblique wall of the concavo-convex portion 8 of the shaft sleeve 1. In use, it is possible for the user to sense the thus produced click in hearing and feeling. Consequently, it is very easy for the user to control the rotary control sleeve 21 in feeding the application liquid to the brush tip 11 from the liquid reservoir portion 14 by the use of the piston 16.

In this case, since there is no fear that the rotary control sleeve 21 is reversely rotated, there is no fear that the piston is moved rearward to cause the air to enter the liquid reservoir portion 14 of the shaft sleeve 1.

CLAIMS

1. A liquid applicator comprising: a tubular shaft sleeve; a liquid-application member at a front-end portion of said shaft sleeve; a liquid reservoir portion communicating with said liquid-application member, said reservoir portion being provided in said shaft sleeve; a piston in said reservoir portion so as to be axially slidable while in sealing contact with said reservoir portion; a threaded rod connected to said piston, said threaded rod being provided with a male screw portion at least at its rear portion; means for preventing said threaded rod from rotating; a rotary control sleeve rotatably mounted at a rear-end portion of said shaft sleeve, said rotary control sleeve being prevented from moving in an axial direction of said shaft sleeve, and having at least one resiliently-deformable engaging projection at its front end; a driving means for driving said threaded rod, said driving means being provided in said rotary control sleeve; and a concavo-convex portion on an inner wall of said shaft sleeve, said concavo-convex portion engaging with said resiliently-deformable engaging projection so that relative movement between the concavo-convex portion and the projection can take place in a single direction only.

2. A liquid applicator according to claim 1, wherein: said concavo-convex portion of said shaft sleeve consists of perpendicular walls extending substantially parallel to a longitudinal axis of said shaft

sleeve and oblique walls extending from said perpendicular walls at an acute angle, said perpendicular walls being spaced alternately with said oblique walls.

3. A liquid applicator according to either of claims 1 and 2, wherein: said driving means for driving said threaded rod comprises a threaded hole in said rotary control sleeve, said threaded hole being a through-hole.

4. A liquid applicator according to either of claims 1 and 2, wherein: said driving means for driving said threaded rod comprises a separate member having a female screw which is threadably engaged with said male screw of said threaded rod, said separate member being fixedly mounted inside said rotary control sleeve.

5. A liquid applicator according to any preceding claim, wherein: a plurality of said resiliently-deformable engaging projections are provided at said front end of said rotary control sleeve.

6. A liquid applicator according to any preceding claim in the form of a writing or painting instrument or a cosmetics applicator.

7. A liquid applicator according to any preceding claim substantially as herein described.

8. A liquid applicator substantially as herein described with reference to the accompanying drawing.